Question on the osmosis required practical

Q1.

A student carried out an investigation using chicken eggs.

This is the method used.

1. Place 5 eggs in acid for 24 hours to dissolve the egg shell.
2. Measure and record the mass of each egg.
3. Place each egg into a separate beaker containing 200 cm^3 of distilled water.
4. After 20 minutes, remove the eggs from the beakers and dry them gently with a paper towel.
5. Measure and record the mass of each egg.

Table 1 shows the results.

Table 1

Egg	Mass of egg without shell in grams	Mass of egg after 20 minutes in grams
1	73.5	77.0
2	70.3	73.9
3	72.4	75.7
4	71.6	73.1
5	70.5	73.8

(a) Another student suggested that the result for egg **4** was anomalous.

Do you agree with the student?

Give a reason for your answer.

_____

_____

_____

(1)

(b) Calculate the percentage change in mass of egg **3**.

_____

_____

Percentage change in mass = _____

(2)

(c) Explain why the masses of the eggs increased.

(3)

(d) Explain how the student could modify the investigation to determine the concentration of the solution inside each egg.

(3)

Chicken egg shells contain calcium. Calcium ions are moved from the shell into the cytoplasm of the egg.

Table 2 shows information about the concentration of calcium ions.

Table 2

Location	**Concentration of calcium ions in arbitrary units**
Egg shell	0.6

Egg cytoplasm	2.1

(e) Explain how calcium ions are moved from the shell into the cytoplasm of the egg.

_____

_____

_____

_____

_____

_____

(3)

(Total 12 marks)

Q1.

(a) (yes, because) the mass change (of egg 4) is much lower than the others

allow because it / egg 4 has gained (over) 50%
less mass than the others
allow it / egg 4 has gained 1.5 g and the others
have all gained more than 3 g (unit required)

1

(b) $\frac{75.7 - 72.4}{72.4} \times 100$

or equivalent

1

4.6 (%)

allow 4.558 / 4.56 (%)
allow any correct rounding of
4.558011049723757

1

*an answer of 4.6 / 4.56 / 4.558 scores **2** marks*

(c) (mass increased because) water entered by osmosis

1

from a dilute solution in the beaker to a more concentrated solution in the egg (cell)

allow from an area of high water concentration in
the beaker to an area of low water concentration
in the egg (cell)
allow ref to water potential
allow ref to 'strong' and 'weak' solutions
ignore along / across concentration gradient
*do **not** accept 'amount' in place of concentration*

through a partially permeable membrane

allow semi-permeable / selectively permeable
membrane

1

(d) use five (or more) different concentrations of salt / sugar solution (in beakers)

allow any number of concentrations provided it is
more than four

1

(by) plotting percentage change (in mass / volume) on / using a graph

1

determine the concentration where the curve / line crosses the zero percentage change (in mass / volume)

1

(e) (ions are moved) from an area of low concentration to high concentration

allow against the concentration gradient

allow in terms of solution
*do **not** accept molecules*

1

(by) active transport

1

(which) requires using energy

*do **not** accept idea of energy being created*

1

[12]

Q1.

(a) Some students stated 'no, because they all increased'. This indicates that they only paid cursory attention to the numbers on the table and did not scrutinise them in sufficient detail.

Those who recognised that the result was anomalous did not go far enough in describing their reason, recognising that it was lower than the other values, rather than being much lower. A few students quoted values derived from the table but omitted the unit.

(b) 54% of students achieved both marks here. However common errors included using 75.7 as the denominator and incorrectly rounding their final answers. Whilst a specific number of significant figures were not required, when students round their values, they're expected to do so correctly.

(c) The great majority of students recognised that this question involved osmosis and that water was passing into the egg. Students' description of the difference in concentration often had responses that referred to both solute concentration and water concentration, although most students realised that the (solute) concentration was greater inside the eggs than outside.

Answers that referred only to amount of water in the beaker / egg did not gain credit. A number of students omitted reference to the nature of the membrane and so failed to gain this final mark.

(d) Many students found this question very demanding with 6% achieving at least one mark. Those who appeared to understand the basic ideas required still did not achieve marks as the question asked for details of the modifications required. Thus simply putting eggs into different concentrations of solution was insufficient; as was looking for an egg which gave no change in mass.

Due to the positive and negative changes, determining where any line crossed the x-axis was also insufficient as the axis could be drawn at different points on a graph, instead, students needed to refer to the zero-percentage change in mass.

(e) This question was generally well answered with 40% achieving full marks. The majority of students recognised that the calcium ion concentration was higher in the cytoplasm and thus deduced that active transport was involved, requiring energy.

Once more, students who referred to energy being made, created or produced could not gain credit for the final marking point.